

Children’s Knowledge of Domain Restriction: The Case of *dōu* (‘all’) in Mandarin Chinese

Margaret Lei

1. Introduction

The difficulties children face in assigning the domain restriction of determiner quantifiers (D-quantifiers) such as *every* and *each* have been robustly reported in the literature. In interpreting universally quantified sentences such as the one exemplified in (1), children tend to reject the sentence if they are presented with an “over-exhaustive” scenario (Philip 2011) in which there is an extra pony without a rider, exhibiting errors known as “symmetrical interpretation” or “quantifier spreading” (Roeper and Mattei 1974; Philip 1995; Crain et al. 1996; Roeper, Strauss, and Pearson 2006; among many others).

(1) *Every boy is riding a pony.*

Such errors have also been found on various non-determiner type quantifiers (A-quantifiers) like the floating quantifiers *allemaal* ‘all’ in Dutch (Smits 2010) and *chacun* ‘each’ in French (Labelle and Valois 2002), as well as the adverbial restrictive focus particle *only* (Crain, Ni, and Conway 1994; Philip and Lynch 2000; Yang 2002; Notley et al. 2009; Zhou and Crain 2010; among others). Most of these quantifiers are largely flexible between their A- and D-quantifier uses, occupying different syntactic positions and in many cases quantifying over different constituents accordingly.

The adverb of quantification *dōu* ‘all, each’ in Mandarin Chinese presents a different scenario. It always occurs preverbally and observes the leftward directionality requirement in selecting a constituent to its left to quantify over. As illustrated in (2), the plural subject noun phrase can be associated with *dōu* as it is on the left of the quantifier, but the object noun phrase cannot as it is on the right of *dōu*.

* Margaret Lei, Language Acquisition Laboratory, The Chinese University of Hong Kong, margaret.lei@link.cuhk.edu.hk. My sincere thanks to Professor Thomas Hun-tak Lee for his valuable advice, and the audience at BUCLD-42 for their comments. I am very grateful to the children, their parents and the staff of the Affiliated Preschool of the National Taipei University of Education Affiliated Experimental Elementary School for their participation in the child language experiments, and all the adult participants who took part in the study. Abbreviations: CL=classifier; CL_{PL}=plural classifier; DUR=durative aspect marker; NOM=nominalizer; PERF=perfective aspect marker.

- (2) 他們 都 買 了 那 些 蛋糕。
 Tamen dou mai le na xie dangao.
 they all buy PERF that CL_{PL} cake
 ‘All of them bought those cakes.’ (subject quantification)
 *‘They bought all those cakes.’ (object quantification)

Earlier studies suggest that Mandarin-speaking children have understood the quantificational meaning of *dōu* at age four (Lee 1986): in interpreting test sentences containing *dōu* (as in (3)), children predominantly favored the “universal” reading over the “partial” reading in a picture identification task.

- (3) 熊貓 都 睡覺 了。
 Xiongmao dou shuijiao le.
 panda all sleep PERF
 ‘All of the pandas slept.’ (Lee 1986)

Children also seem to be sensitive to the domain restriction of *dōu* in conditionals (Zhou and Crain 2011): they allowed *dōu* to quantify over a *wh*-word on its left, as in the antecedent clause in (4). However, when the *wh*-word occurs on the right of *dōu*, as in the consequent clause in (5), it cannot be quantified over by *dōu* and thus only an interrogative interpretation is possible.

- (4) 鱷魚 去 咬 誰， 貓頭鷹 村長
 Eyu qu yao shei, maotouying cunzhang
 crocodile go bite who owl village.head
 都 找 了 蜘蛛俠 幫忙。
 dou zhao le Zhizhuxia bangmang.
 all find PERF Spiderman help
 ‘Whoever Mr. Crocodile went to bite, Mr. Owl asked Spiderman for help.’ (Zhou and Crain 2011)

- (5) 鱷魚 去 咬 小豬， 貓頭鷹 村長
 Eyu qu yao xiaozhu, maotouying cunzhang
 crocodile go bite pig owl village.head
 都 找 了 誰 幫忙？
 dou zhao le shei bangmang?
 all find PERF who help
 ‘Who did Mr. Owl ask for help when Mr. Crocodile went to bite Mr. Pig?’ (Zhou and Crain 2011)

In addition, Mandarin-speaking four- and five-year-olds are sensitive to the scopal differences between a numeral phrase object and a bare noun object in interpreting *dōu*-sentences containing a subject universal quantifier (Lee 1997): the cumulative reading was only compatible with *dōu*-sentences taking a bare noun object, as in (6), but not those taking a numeral phrase object, as in (7).

(6) 所有 的 叔叔 都 挑 著 水桶。
 Souyou de shushu dou tiao zhe shuitong.
 all NOM uncle each carry DUR water.bucket
 ‘All the men are carrying (on their shoulder) water buckets.’

(7) 所有 的 叔叔 都 挑 著 兩 桶 水。
 Souyou de shushu dou tiao zhe liang tong shui.
 all NOM uncle each carry DUR two CL water
 ‘All the men are carrying (on their shoulder) two buckets of water.’

In view of the fact that no previous studies have tested children’s interpretation of *dōu* in situations involving more than one quantificational domain, the present study examines whether Mandarin-speaking children can correctly restrict the domain of *dōu* in ambiguous situations in which both the subject nominal and the object nominal can potentially serve as the domain of quantification. The following research questions are addressed:

(i) Are Mandarin-speaking children sensitive to the leftward directionality requirement of *dōu*-quantification?

(ii) Do they exhibit errors of “symmetrical interpretation” or “quantifier spreading” in interpreting the domain of *dōu*?

2. The present study

We conducted an experiment using the Truth Value Judgment (TVJ) task (Crain and Thornton 1998) to examine whether Mandarin-speaking children can correctly restrict the domain of *dōu* in ambiguous situations involving more than one potential domain for quantification.

2.1. Participants

Fifty-three children between the ages of 4;4 and 6;3 and ten college-age adults who were native speakers of Mandarin Chinese took part in the experiment.

The child participants were recruited from a kindergarten in the Taipei city of Taiwan. The adult participants were born in Taiwan and spoke Taiwan Mandarin as their mother tongue.

2.2. Test materials and experiment design

We adopted a between-subject design on test sentence type (bare noun object condition vs. numeral phrase object condition). In the experiment, one group of participants (31 children and 5 adults) was assigned to the bare noun object condition, in which the *dōu*-sentences contained a bare noun object, as in (8a) and (9a), and another group of participants (22 children and 5 adults) was assigned to the numeral phrase object condition, in which the *dōu*-sentences contained a numeral phrase object, as in (8b) and (9b). In both conditions, the subject noun phrase was always a bare noun.

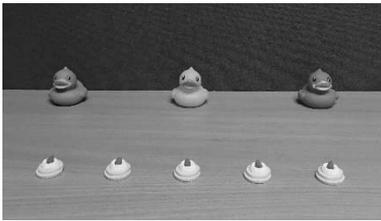
- (8) a. 小鴨 都 買 了 蛋糕。
 Xiaoya dou mai le dangao.
 little.duck all buy PERF cake
 ‘All the little ducks bought cakes.’
- b. 小鴨 都 買 了 一 個 蛋糕。
 Xiaoya dou mai le yi ge dangao.
 little.duck all buy PERF a/one CL cake
 ‘All the little ducks bought a cake.’
- (9) a. 小鴨 都 戴 了 項鍊。
 Xiaoya dou dai le xianglian.
 little.duck all wear PERF necklace
 ‘All the little ducks wore necklaces.’
- b. 小鴨 都 戴 了 一 條 項鍊。
 Xiaoya dou dai le yi tiao xianglian.
 little.duck all wear PERF a/one CL necklace
 ‘All the little ducks wore a necklace.’

The Truth Value Judgment task consisted of six test sentences on *dōu*. Three of the *dōu*-sentences containing a bare noun object or a numeral phrase object (depending on test condition) were paired with a subject-universal event (universal quantification over the subject denotation), and another three of the *dōu*-sentences were paired with an object-universal event (universal quantification over the object denotation).

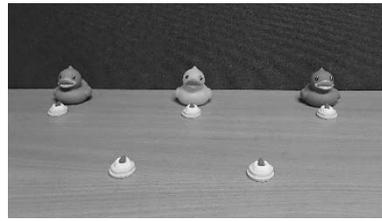
A subject-universal event described a situation in which all three members of the subject set performed an action on three of the five members of the object set in a one-to-one manner. As all three members of the subject set were involved but two members of the object set were not involved, the event presented an “over-exhaustive” scenario (Philip 2011). On a typical trial, the test sentence was presented at the end of a short story that depicted either a subject-universal event or an object-universal event (see Section 2.3 for details of the experiment procedure). A sample story depicting a subject-universal event is provided in (10), with photos showing the first and last scenes of the story given in Figure 1.

(10) A sample story depicting a subject-universal event

“This is a story about the duck family. Today, Little Red Duck, Little Yellow Duck, and Little Blue Duck go to the park. They spend all day playing in the park, and they become very tired and hungry. As they walk on, they see a snack shop, and they go inside for something to eat. There are five slices of cake for sale. Little Red Duck loves cake, so she buys one of the slices. Little Yellow Duck doesn’t really want cake, but she is far too hungry, so she buys one of the slices too. Little Blue Duck sees the fruit on top of the cake and thinks that it looks very nice, so she also buys a slice of cake.”



(a) First scene of the story



(b) Last scene of the story

Figure 1 Photos showing the first and last scenes of a subject-universal event (“over-exhaustive” pairing) paired with test sentence (8a) or (8b)

An object-universal event described a situation in which all three members of the object set were acted on by three of the five members of the subject set in a one-to-one manner. As all three members of the object set were involved but two members of the subject set were not involved, the event presented an “under-exhaustive” scenario (Philip 2011). A sample story that depicted an object-universal event is provided in (11), with photos showing the first and last scenes of the story given in Figure 2.

(11) A sample story depicting an object-universal event

“Mickey Mouse’s birthday party will be held today. He invites Little Red Duck, Little Yellow Duck, Little Blue Duck, Little Black Duck, and Little Green Duck to the party so that they can have fun together. Before leaving for the party, the five of them are dressing themselves up at home. There are three necklaces. Little Red Duck thinks that the necklaces are beautiful, so she takes one of the necklaces. Little Yellow Duck doesn’t want to wear a necklace as he is a boy. Little Blue Duck sees that there are little hearts on the necklaces, and she thinks that they look very nice, so she puts on one of the necklaces. The necklaces are too short for Little Black Duck, so he doesn’t put on one. Little Green Duck has never seen such a beautiful necklace before, so she takes the last necklace.”

Participants also received four training items and six control items. The test items were presented in a pseudo-randomized order.



(a) First scene of the story



(b) Last scene of the story

Figure 2 Photos showing the first and last scenes of an object-universal event (“under-exhaustive” pairing) paired with test sentence (9a) or (9b)

2.3. Procedure

The child participants were tested individually in a classroom at a kindergarten. In the experiment, the child was told that s/he was going to listen to some stories with Mickey Mouse. The stories were told by the experimenter with the aid of sequences of photos presented on a laptop computer. At the end of each story, Mickey Mouse would utter something about what happened in the story, and the child was asked to judge Mickey Mouse’s description (i.e. the test sentences) as “right” or “wrong”. If the child judged Mickey Mouse’s saying as “wrong”, s/he would be instructed by the experimenter to explain to Mickey Mouse why it was wrong. The whole TVJ experiment for each child lasted around 10 to 15 minutes.

The adult participants were tested individually with the test materials presented in pre-recorded clips. They were asked to write down their answers to the test sentences on an answer sheet.

2.4. Predictions

Since *dōu* imposes the leftward directionality requirement on its domain restriction, only the subject noun phrase can serve as a plausible domain for *dōu*-quantification. The object noun phrase, be it in the form of a bare noun object or a numeral phrase object, cannot be quantified over by *dōu*. Thus, both the group of participants tested in the bare noun condition and the group tested in the numeral phrase object condition were expected to accept the subject-universal reading but reject the object-universal reading in our Truth Value Judgment task.

As the subject-universal events depicted “over-exhaustive” pairings, some of the children might exhibit the error of “symmetrical interpretation” (Philip 1995) or “quantifier spreading” (Roeper and Mattei 1974) in wrongly rejecting the subject-universal events. But given that the Mandarin *dōu* is invariant in its syntactic position and directionality of quantification, Mandarin-speaking children were expected to exhibit such errors less readily than what have been previously reported on other types of quantifiers that are largely flexible in their syntactic position and domain of quantification.

In view of the fact that bare noun objects are more permissive of cumulative readings than numeral phrase objects in their relative scope to a subject universal quantifier (Lee 1997), the distributive subject-universal events presented in our experiment were predicted to be less well received in the bare noun object condition than in the numeral phrase object condition.

2.5. Results

The results were analyzed in terms of overall group acceptance rates of the subject-universal reading and the object-universal reading, and the individual acceptance patterns of the two readings. In our analysis, a participant's acceptance of a reading (subject-universal reading or object-universal reading) was considered to be consistent if s/he accepted it in at least two of the three test trials; similarly, a participant's rejection of a reading (subject-universal reading or object-universal reading) was considered to be consistent if s/he rejected it in at least two of the three test trials.

2.5.1. Overall group acceptance rates

In terms of overall group acceptance rates (see Table 1), the adult participants accepted the subject-universal reading and rejected the object-universal reading at all times, both in the numeral phrase object condition and the bare noun object condition. The child participants behaved like the adults in strongly rejecting the incorrect object-universal reading, which was barely accepted 9.7% of the time in the bare noun object condition and 0% of the time in the numeral phrase object condition. They also resembled the adults in showing a much higher acceptance of the correct subject-universal reading than the object-universal reading, as reflected in a sharp contrast between the high acceptance rates of the subject-universal reading (64.5% in the bare noun object condition and 74.2% in the numeral phrase object condition) and the low acceptance rates of the object-universal reading (9.7% in the bare noun object condition and 0% in the numeral phrase object condition). Children, however, differed from the adults in accepting the subject-universal reading less readily (children: 64.5%-74.2% vs. adults: 100%).

2.5.2. Individual acceptance patterns

In terms of individual acceptance patterns (see Table 2), all of the adults consistently accepted the subject-universal reading and rejected the object-universal reading, in the bare noun object condition as in the numeral phrase object condition. As for the children, while 64.5% of them in the bare noun object condition and 72.7% in the numeral phrase object condition resembled the adults in consistently accepting the subject-universal reading, the reading was consistently rejected by 35.5% of them in the bare noun object condition and

27.3% in the numeral phrase object condition. Similar to the adults, the object-universal reading was consistently rejected by all except two of the children.

Table 1 Percentage of group who accepted the subject-universal reading and the object-universal reading in the bare noun object condition and the numeral phrase object condition

Group	Subject-universal ("over-exhaustive")	Object-universal ("under-exhaustive")
Bare noun object condition		
Children (N=31)	64.5%	9.7%
Adults (N=5)	100%	0%
Numeral phrase object condition		
Children (N=22)	74.2%	0%
Adults (N=5)	100%	0%

Table 2 Number (percentage) of participants who consistently accepted/rejected the subject-universal reading (SA) and the object-universal reading (OA) in the bare noun object condition and the numeral phrase object condition

Group	Accepting SA	Rejecting SA	Accepting OA	Rejecting OA
Bare noun object condition				
Children (N=31)	20 (64.5%)	11 (35.5%)	2 (6.5%)	29 (93.5%)
Adults (N=5)	5 (100%)	0 (0%)	0 (0%)	5 (100%)
Numeral phrase object condition				
Children (N=22)	16 (72.7%)	6 (27.3%)	0 (0%)	22 (100%)
Adults (N=5)	5 (100%)	0 (0%)	0 (0%)	5 (100%)

3. General discussion and conclusions

Our findings demonstrate that Mandarin-speaking children are well aware of the leftward directionality requirement of *dōu*-quantification by the age of five. They showed a much higher acceptance of the subject-universal reading of *dōu* than the object-universal reading in our Truth Value Judgment task.

The correct subject-universal reading was, however, consistently rejected by one-fourth to one-third of the children in the numeral phrase object condition and

the bare noun object condition respectively. As the subject-universal events presented in our experiment involved “over-exhaustive” pairings, children’s rejections could be discerned as exhibiting errors of “symmetrical interpretation” (Philip 1995) or “quantifier spreading” (Roeper and Mattei 1974). This suggests that such errors are not restricted to determiner quantifiers or quantifiers that are flexible in their syntactic position and quantificational domain, but also ones like the Mandarin *dōu* that is generally invariant in its syntactic position and directionality of quantification.

Moreover, the distributive subject-universal readings were less readily accepted in the bare noun object condition than in the numeral phrase object condition, corroborating with previous findings on the different quantificational interpretations that Mandarin-speaking children assigned to bare nouns and numeral phrases (Lee 1997; Lee and Wu 2013). As bare nouns may be treated as kind-denoting and non-quantificational (Lee and Wu 2013), and that bare noun objects are more permissive of cumulative readings than numeral phrase objects in their relative scope to a subject universal quantifier (Lee 1997), children might therefore find it more difficult to reliably assign a distributive subject-universal reading to *dōu* in sentences taking a bare noun object than the ones taking a numeral phrase object.

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